MONDAY, JANUARY 10TH, 1853.

JOHN ANSTER, LL. D., VICE-PRESIDENT, in the Chair.

GILBERT SANDERS, Esq., was elected a Member of the Academy.

On the recommendation of the Council, it was Resolved,—

"That leave be given to read Papers of which the general nature shall have been approved by Council, but that, unless an Abstract of a Paper shall be delivered to the Secretary of the Council, on or before the night of reading, the title only of it shall be published in the Proceedings of the Academy."

A letter from Mr. Macaulay, returning thanks for his election as an Honorary Member, was read.

The Rev. Professor Graves communicated the following theorem relating to the total curvature of bounded portions of surfaces:—

If a closed curve B *be traced on any surface whatsoever,* S, *the total curvature of the included portion of the surface may be represented by means of the following construction:—Let a developable surface,* D, *be circumscribed along the bounding curve, and let it be opened by cutting it along one of its rectilinear generatrices,* G, *and developed upon a plane; then the angle between* $g\ g'$, *the two right lines which correspond to that generatrix, will represent the total curvature of the proposed portion of the surface.*

To prove this theorem, let us conceive a sphere whose radius is unity. Let a cone, C, be formed by radii paralel to the rectilinear generatrices of the circumscribed developable

D. Let its intersection with the sphere be the curve c, and let the supplemental cone and corresponding spherical curve be C' and c'.

Then the total curvature of the proposed portion of the given surface S is equal to the portion of the spherical surface included by the radii drawn parallel to the normals to S along the curve B. But as the plane of two consecutive sides of the cone C is parallel to the plane of two consecutive generatrices of the developable D, and as this latter plane touches the surface S at a point on the bounding curve B, it follows that the area of the curve c' represents the total curvature of the proposed part of the surface S. But the area of c' is equal to 2π, diminished by the perimeter of the curve c. And as the angle between two consecutive sides of the cone C is equal to that between two consecutive generatrices of D, which remains unaltered by development, it follows that the total curvature of the proposed portion of S is equal to four right angles diminished by the angle through which g must turn as it assumes all the positions of tangency to the developed edge of regression of D, until finally it comes into the position of g'. And thus the theorem is proved.

The right lines g and g' being equally inclined to the initial and final elements of the developed curve, the angle between the tangents to these elements is equal to that between g and g'. We may therefore represent the total curvature of the proposed portion of the surface S by the angle between the tangents to the initial and final elements of the developed curve; or, what is the same thing, by four right angles diminished by the entire angle through which the tangent to the developed curve is turned as it passes from its first to its last position.

Many interesting corollaries may be deduced from the preceding theorem.

If the proposed boundary B be a closed geodetic curve returning into itself, the total curvature of the included portion of the surface will be equal to a hemisphere. And hence, if

radii of a sphere be drawn parallel to the radii of absolute curvature of any closed curve whatsoever, they will divide the sphere into two equal parts; for the proposed curve may be regarded as a geodetic line upon a surface so described that the tangent plane at any point along the given curve is perpendicular to the radius of absolute curvature at that point.

If the boundary curve be a loop of a geodetic line, the total curvature of the included portion of the surface is equal to a hemisphere diminished by the external angle of the loop.

If the boundary be a polygon whose sides are geodetic lines, the total curvature will be equal to a hemisphere diminished by the sum of the external angles of the figure. This proposition includes Gauss' celebrated theorem respecting the total curvature of a triangle formed on any surface with geodetic lines.

If the surface S be itself a sphere, we can represent the *area* of any closed curve B traced upon it by a plane angle. For this purpose, let a developable surface be circumscribed along the curve B, and let the angle be constructed as in the theorem. In this way we find the area of a small circle of the sphere to be equal to the defect by which the developed angle of the circumscribed cone falls short of four right angles.

The Rev. Professor Haughton communicated the following account of some barometric determinations of height made by him, with the view of examining by direct observation the different formulæ which have been proposed for introducing the hygrometric condition of the air into the calculation of heights:—

The uncorrected barometric formula is the following:—

$$H = 10000^{fath.}\left(1 + \frac{\Theta}{493}\right)\log\frac{p}{p'} \qquad \text{(I.)}$$

in which Θ denotes the mean excess of the temperature of the